DOCUMENT RESUME

ED 261 658 IR 011 807

AUTHOR Adams, Frank
TITLE Educational Research Workshop on Computers and Science in Primary Education. General Report.
INSTITUTION Council for Cultural Cooperation, Strasbourg (France).
REPORT NO DECS/Rech-(84)-58
PUB DATE 8 Oct 84
NOTE 13p.; Paper presented at the Educational Research Workshop (Edinburgh, Scotland, September 3-6, 1984).
PUB TYPE Speeches/Conference Papers (150) -- Reports - General (140)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Classroom Research; Cognitive Processes; *Curriculum Design; *Curriculum Development; Curriculum Evaluation; Elementary Education; *Epistemology; Instructional Improvement; *Microcomputers; *Research and Development; Skill Analysis; Skill Development; *Teacher Role

ABSTRACT

Presented at a week-long conference on the importance of research in education, this paper focuses on four components of the educational system: the learner, the curriculum, the instructor, and the context. For each of these components, questions are raised and research is suggested. For the learner, these concern the value of research for learner analysis, the existence of models of learners, use of alternative frameworks, criteria for judging success, and links between quantitative and qualitative research to equate quality with width. Research needs in the area of instructor role in learning point to what the teacher needs to know, and the concept of teacher-as-researcher is stressed as a way of improving classroom instruction. A discussion on the content and process of a curriculum calls for the development of a scientific method that would be widely applicable; questions concerning content, context, skills, and structure of a curriculum are also included. Effective classroom organization and management are suggested for enhancement of learning, and inservice education and training are deemed necessary for more teacher research and education to take place. Computers are suggested as a resource for teaching and learning, with a warning not to allow their use to dictate the curriculum structure. Concluding remarks reiterate the importance of research for good instruction, and list seven guidelines for determining research effectiveness as a basis for curriculum policy. (JB)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

COUNCIL OF EUROPE
CONSEIL DE L'EUROPE

Strasbourg, 8 October 1984

DECS/Rech (84) 58
Or. Engl.

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

ED261658

COUNCIL FOR CULTURAL CO-OPERATION

Educational Research Workshop on computers and science in primary education

Edinburgh (Scotland), 3-6 September 1984

GENERAL REPORT

by

Mr. Frank ADAMS

Scottish Curriculum Development Service,
Moray House College of Education,
Holyrood Road, GB - EDINBURGH EH8 8AQ

"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY
W. F. Barrett
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

BEST COPY AVAILABLE

IR011807

1.729
04.6

AS THIS DOCUMENT WILL NOT BE DISTRIBUTED DURING THE MEETING
PLEASE BRING THIS COPY

The chairman, at the beginning of this week, reminded us that this week was to be a RESEARCH workshop rather than a workshop on curriculum development and it is important in reflecting on the workshop to keep that in mind. However, it is difficult, and perhaps undesirable, to make too clear a distinction between research and development as research must constantly inform and underpin curriculum development. Similarly, it is problematic at times to define curriculum for it can be interpreted, depending upon our background, as being simply a syllabus or list of content or it may have a wider interpretation to take in methodologies, organisation, assessment and all of the experiences planned and unplanned that a child will have in his years at school. The Committee on Primary Education (COPE) adopts a wide definition of curriculum taking, therefore, a view which relates to the individual child and which seeks to bring as many of the outcomes of his experience as possible into the conscious awareness of the teacher. Research, therefore, has much to contribute to our understanding of the child, of the experiences we believe are worthwhile for him and of the situations which will allow us as educators to provide the best possible conditions for that child to grow into a happy, healthy individual.

> '..... with a proper respect and concern for others as well as themselves, able to make rational choices, able to act as part of a group or with confident independence when that is appropriate.' (Primary Education in the Eighties, COPE 1983).

That's all very well many teachers would say. It's easy to make these broad assertions but we are the ones who have to make it all happen. How is it to be done? Statements such as the one I have just made form the manifesto but within it there must be more specific guidance on how these aims for all of primary education are to be achieved and where the major contributions lie.

Science and the use of computers must be seen as contributing to the achievement of such an aim and this workshop has perhaps helped us to either see or begin to see afresh the important role that science and microcomputers play in a broad and balanced curriculum.

On the first day Professor Black suggested that one of the difficulties that may have existed (or continues to exist) is the tendency to fail to look at an overall system and try to influence all of the elements within that system. Advances are made on some fronts while others are neglected. Perhaps this is inevitable - different people have different interests and it may be hard to agree on priorities when there are competing claims for finite - and perhaps diminishing - resources. Perhaps a priority is for us to agree on the system itself and what we do and do not understand within it. Clearly that is the aim of this workshop.

It seems to me that we have been operating this week on a system with at least the following components:

CHILD
- how does he learn?
- how do we know what he has learned?
- what criteria do we use to evaluate success?

CURRICULUM
- how does it relate to the 'real world' of the child?
- what is the place of science?
- what should be taught?
- how should it be structured?
- how should it be taught?

TEACHER
- what skills and qualities are needed?
- how can they be developed?
- how should research help?

CONTEXT
- how is it to be defined?
- how is it to be organised?
- what are reasonable criteria for success?
- how can research help?

and I propose to make my remarks within the structure of this system without taking each element in turn. Some of the research presented this week has given indications of what we know and do not know about a number of these areas.

THE LEARNER

It is encouraging that there appears to have been no need or attempt to unearth the old issue of child-centredness v structure in the curriculum. The child has been firmly at the centre of the discussions that have taken place during this workshop. That may be so but some issues seem more difficult to resolve, e.g. how does he learn? What is the model of the learner that is at the centre of our concern? Important points have been made about the need for an active learner who is creating his own understandings of the world around him. Thus the child's explanations of the world are to be taken seriously but teachers need help that will allow them to judge when the 'alternative framework', proposed by Professor Anderson, is perhaps likely to impede progress and when it is not. How is that to be judged? How can teachers distinguish between an 'alternative framework' and a misunderstanding or misconception? It would seem to be good practice in either case to begin from where the learner is but are the routes to be followed from each the same? This workshop has identified the need for clarification of this issue and a research programme linking the implications of identifying pupils' difficulties as either 'alternative frameworks' or misunderstanding and the subsequent action that teachers or curriculum developers might take seems to be needed. The criteria for judging success in the field of science also need clarification. It seems clear from the APU studies referred to by Professor Black that this is a complex area yet it is one in which it is tempting for some audiences to go from correlation to causation, e.g. class size issue. Professor Black suggested large-scale surveys were important but that smaller scale research is not ruled out. What kind of research strategy is needed to link large-scale quantitative research with perhaps smaller-scale qualitative research so that we do not equate "quality with width"? Can research in assessment of performance help to clarify difficult areas such as process and help to lay the foundation for more extended development (Paper 1, p.9) or is there a danger that the process will become limited to that which is assessable? Can research say to the teacher what her expectations of the learner might be and whether we are asking too much or too little of children?

Implicit in all of our discussions about the learner has been a model of the teacher. Some delegates have been happy to accept a constructivist view of the learner but needed to add something more. Perhaps it was the teacher. The picture we have been building up of the learner might have been seen by

some to imply a relatively passive role for the teacher - the teacher as restaurateur who presents an attractive buffet of possibilities but little more. Clearly there is more to it than that and much depends on sensitive intervention on the part of the teacher, particularly in terms of the crucial role that language and communication, Pupil-Pupil and Teacher-Pupil, play in the construction of understandings. The suggestion has been made that the teacher needs to adopt a more central role through her own understanding of science as she would in reading or in mathematics. Clearly to do this the teacher will require help, particularly if a lack of familiarity with science has been identified as one of the obstacles to development. What does the teacher need to know? It is perhaps in this area that most research needs to be carried out. If we are to build on pupil's alternative frameworks what are the activities that help the child to form concepts and progress from limited concepts to more sophisticated ones? How can we recognize changes in the child? These are important issues that relate to a wide spectrum of activities both in the primary school and at the transition from primary to secondary education. But who is to do this? The researcher - who may produce complex and unmanageable taxonomies or the teacher who may lack the background insights. The late Lawrence Stenhouse's concept of the teacher-as-researcher seems to me to be important in this issue. Through such a concept the teacher may be helped to develop an awareness of criteria that are meaningful to her within her own classroom situation.

CURRICULUM STRUCTURE

The network of issues about content, process and curriculum structure remains complex and a resistant to attempts at simplification. The issue of what should be taught and how is important whether the teacher is attempting to make provision within a national syllabus or within a school. Sinclair MacLeod suggested that a school policy for science should relate to philosophy, strategy and programme and so should any national syllabus. The question remains who is to decide what that philosophy, strategy and programme are to be and how? It seems clear that the debate is NOT content versus process but rather what do we mean by content and process? At the least I believe we can agree that content must exist as a vehicle for the development of a scientific method - which is widely applicable across the primary curriculum.

As Professor Black put it

> ".... the question at issue is whether the topics used for this purpose should be pre-specified" (Paper 1, p.9)

Wynne Harlen, quoted in a recent UNESCO publication 'New Trends in Primary Science' sums it up as

> "while children are investigating problems and developing scientific skills and attitudes what is the core of generalisations that they should at the same time acquire?"

The Primary Science Development Project in Scotland seems to suggest that teachers can agree on broad areas of content. Is that what we mean by a 'core of generalisations'? Can a core be suggested and be relevant for all school contexts? Can we be sure of the generalisations that would be meaningful to children at different stages of the primary school and which could be built on in secondary education? Bruner's notion of a 'spiral curriculum' is crucial in thinking about these matters.

Context is important to the teacher in terms of the school and its community - but also to the child. Can we balance prespecified generalisations with room to respond to particular local/temporal/even individual demands? It seems clear that there should be a difference between ad hoc unplanned work and work which is responsive to the reactions of children. But is there? Would a core of content give teachers the confidence to react in a responsive way to questions which - if we have done a good job in process terms - cannot be entirely predicted.

What about process? Is process entirely about skills? I suppose it depends on how you define a skill. Is it a psychomotor process skill? If so there may appear to be no problem until you begin to try to work out how to mark progression. But what we call skills are not necessarily exclusively psychomotor. What we know about the world makes us better at applying a skill. What we mean by know is more controversial - I think that it is not simply information.

As Henri Poincaré put it

> "Science is built of facts the way a house is built of bricks; but an accumulation of facts is no more science than a pile of bricks is a house."

Part of the process skills for the learner is knowing you've got them or when to use them. That is being aware of your own thinking processes - the area of psychology called meta cognition. How can we make children aware of their skills? When can children begin to reflect constructively on their own performance? Can all children do it in varying degrees? What classroom activities will support its development. Research is currently being carried out in the field of learning to learn by Professor Nisbet and his colleagues at Aberdeen University and it may be useful for more information on this to be made available within Europe and in a way that can inform classroom practice.

Structure must however also include some thoughts about the place of science in the primary curriculum. I have already suggested that context is the important issue. Context for me implies purpose and an understanding of purpose on the part of the child. Part of the issue is the source of problems or topics for investigation. Whose reality is being operated on - the teacher's or the child's? Meaningful learning is more likely to take place when connections are made with past learning, with real problems than when the ideas are inert. Is it any more meaningful to swing pieces of plasticene on a length of string because that's what you've been told to do than it is to write about Transport Through the Ages or do a page of long multiplication because that's that you've been told to do? I know what's likely to be more fun. The curriculum development case studies from Switzerland (paper 4b) and from Scotland (paper 5) raised the issue of whether Science should be developed as part of a more or less 'integrated' curriculum or as a separate subject of study. The issue doesn't appear to be simply about subjects or no subjects but more about the contribution certain ways of thinking can make to our understanding of the world. It is difficult to say what integration actually is. A broad and balanced view of what constitutes experience of the world cannot accept anything being "integrated away". Policies at both national and school level which make clear the contribution of the various traditional subjects to the development of an integrated view of the world can help to avoid this.

BEST COPY AVAILABLE

It could be argued that the child in primary school brought up on a diet of investigation and process will get to the stage when he/she needs fairly specialised bits of information in order to understand a particular phenomenon but that's not the same as storing up specialised/subject information in case you'll ever need it. I believe teachers do need practical help in this issue because the rhetoric of primary education is about integration, inter-relationships and seamless robes but teachers are faced with problems of progression and continuity that are increasingly complex unless research can help us to identify, e.g. certain process skills that go across the curriculum or a manageable number of ideas about teaching and learning that fit a range of curricular contexts e.g. drafting and editing in writing across the curriculum, so called 'discussion skills', etc.

CLASSROOM ORGANISATION AND MANAGEMENT

If we are to operate on all aspects of the system then it is clear that concise help is needed to show teachers how to create a classroom/management context which is reasonably simple but which can cope with active, co-operative work on the part of all of the children some of the time. We have been reminded of the importance of whole class work from time to time by the work of Professor Galton among others. The important point would appear to be that the teacher ought to be able to change her teaching style depending upon the purpose of the activity. This must be part of the increased awareness of possibilities that I suggested earlier ought to be part of the characteristics of good teaching. What research might do is to link purpose more clearly with mode of teaching and classroom management.

Group One's report asked what are the conditions that are likely to enhance learning? How can the task be matched to the pupil's level of ability? This is a growing field of research and one which can be of immediate relevance to the classroom e.g. information on feedback from the ORACLE* project underlines its importance in the teaching and learning process. This is far from new but it is very important and immediately suggests certain practical steps that can be taken in classrooms by teachers.

I commend to the Workshop Professor Galton's paper (DECS/Rech (83) 25) given at the Council of Europe Conference at Neusiedl because the implications that it contains for research and development related to classroom organisation and management throughout Europe are very important.

* Observational Research and Classroom Learning Evaluation, University of Leicester

IN-SERVICE EDUCATION AND TRAINING

Dr. Lauterbach has summed up the problem both in his metaphor of throwing a rock into a deep well and seeing little effect (resource problem) and through his research. If we begin from where the teachers are then it is crucial to keep their perceived needs in mind as well as our perception of priorities. The link between the need for research into classroom organisation and management and the expressed needs of teachers for help with classroom management is clear and should be amenable to more or less instant help - not only through formal courses but in the informal ongoing contact between teacher and teacher and teacher and promoted staff in schools. Valuable in-school opportunities need to be exploited by the schools themselves and they should receive the support they need to do this. Other problems are less amenable - what can be done about differentiating in-service to teacher needs just as we try to differentiate the curriculum for pupil needs? Research such as that presented by Dr. Lauterbach can confirm the truth we all know that the effects of INSET may be transient for a range of reasons. What we now need is a vigorous exchange of ideas and information about strategies to combat the factors that combine to diminish INSET effects.

COMPUTERS

Up to now I have not mentioned computers. This is not an oversight nor is it a Luddite reaction to new technology. There have been many seminars, workshops and discussions on computers and primary education and a range of conclusions and recommendations exist about the kind of hardware, what software, what language and so on. What must be fundamental is that the microcomputer is a resource for teaching and learning, albeit a very powerful one, just like any other resource available to the teacher. For the teacher the important feature must be the decisions that determine the selection and use of certain resources for certain purposes. The microcomputer is at the forefront of attention for many teachers at present. As M. Robert so eloquently put it - when did Government last specially fund a resource for use in schools? The microcomputer in many countries has been thrust into teachers' consciousness by Government action and naturally there is a demand for software and for INSET. But it is important to be clear on why and to what end. The rapid introduction created a demand and it is probably easier to develop drill programmes than other kinds. But should a resource dictate the curriculum in this way? Clearly there have been and

there continues to be great improvement but there is much that we still do not know and research must help us here - for example, can the computer - using appropriate software (logo/adventure games) stimulate a better quality of interaction among groups of children, because of its speed and power?

Should we be asking about the effects of having more than one computer in a school so that it is available on a long term basis to all teachers? When and under what circumstances is the computer more than a frill? In other words should our research be more oriented to the curriculum, to teaching/ learning and pedagogy than to software systems. The workshop is clear that the issue is not LOGO v the rest but how the various strengths of the computer as a resource relate to the child as a learner. Researchers are already aware of the potential danger that the microcomputer can have in taking children away from the real physical world into an abstract model of the world and it may be salutary in a workshop on science to keep that in mind.

CONCLUSION

I began by emphasising the improtance of research in this workshop. It is clear that research is important to teaching but we must be clear about our expectations of research. Sir William Pyle who was Permanent Under-Secretary at the DES from 1971-76 is often quoted as follows:

> "I have to say of course that the great thing about educational research is that part of it is rubbish and another part (I will not be specific about the proportions) leads nowhere and is really indifferent; it is I am afraid exceptional to find a piece of research that hits the nail on the head and tells you pretty clearly what is wrong or what is happening or what should be done."

This of course will meet different reactions from different audiences but what it does make clear is that it is important not to raise false hopes in research either for the administrator/policy maker or the classroom teacher. Research in education cannot always be an exact science. What is perhaps more important in ensuring the effectiveness of research is to make sure it gets known about and talked about. A recent journal article (in the Journal of Curriculum Studies 1982) suggested that for research to be effective as a basis for curriculum policy it should:

have authority

have novelty

be more than common sense

suggest development

have coherence

have sympathy

ring true

be practical (which is not necessarily the same as simple)

- RESEARCH AS A BASIS FOR CURRICULUM POLICY
(ANDERSON, JOURNAL CURRICULUM STUDIES, 1982)

This may be an oversimplification but the underlying message is clear. Part of the researcher's task is to communicate the results of research but increasingly the researcher must think of ways of involving teachers in the formulation and implementation of research. Administrators and policy makers must also be involved in planning research and must share with the researcher the task of making the results accessible and meaningful for those who will make use of them.

BIBLIOGRAPHY

ANDERSON, D.C. RESEARCH AS A BASIS FOR CURRICULUM POLICY MAKING: A CAUTIONARY NOTE

JOURNAL OF CURRICULUM STUDIES, VOL. 14, No.1, 1982

CONSULTATIVE COMMITTEE ON THE CURRICULUM: COMMITTEE ON PRIMARY EDUCATION (COPE) PRIMARY EDUCATION IN THE EIGHTIES

SCOTTISH CURRICULUM DEVELOPMENT SERVICE, EDINBURGH CENTRE, 1983.

NEW TRENDS IN PRIMARY SCIENCE, UNESCO 1984

POINCARÉ, H. LA SCIENCE ET L'HYPOTHESE, 1902